Hello everyone!! I hope you are all enjoying the Biology ICB class. Remember we continue to have group Tutoring for this class each week. If you cannot make it to Group Tutoring, also know that these resources are available to you in the tutoring center website. If you wish to attend group tutoring, make sure you reserve a spot via the tutoring center website.

**Our Group Tutoring sessions will be every Tuesday from 6:00 – 7:00 PM. You can reserve a spot at [https://baylor.edu/tutoring](https://baylor.edu/tutoring). I hope to see you there!**

Last week, we went over how genetic diseases arise and looked into different experiments evaluating the importance of DNA polymerase. That resource can be found here: [https://www.baylor.edu/support_programs/index.php?id=967950](https://www.baylor.edu/support_programs/index.php?id=967950)

This week, we will get into chapter 6 and answer the following questions: **how did the first nucleus come into being?, how does a whole genome fit inside a tiny nucleus, and how did mitochondria and chloroplasts originate?**

Let’s begin with **how the first nucleus appeared.** Remember that if we talk about a nucleus, then we are talking about eukaryotic cells. So basically we are exploring how eukaryotic cells started to evolve. It would be a good idea to revisit the concept of the “tree of life”, which is a Darwinian concept suggesting how species have evolved from common ancestors and probably the idea that you (and people in general) are more familiar with. However, things get a little more complex with evolution and we need to focus more on the “ring of life”, which suggests that eukaryotes are basically a combination of features from bacteria and archaea, as shown in the figures to the right.

**Useful observations:**

- DNA replication, transcription and translation in eukaryotes seem to be from archaea origin.
- Contrarily, energy harvesting genes seem to be from bacterial origin.
Also, please revisit the endosymbiont theory using the diagram below. This will help you understand how smaller, unicellular organisms are suggested to have been “engulfed” by larger organisms. According to this theory, this was the origin of eukaryotes.

You may also want to check the following video that gives a nice perspective on the endosymbiotic theory: https://www.youtube.com/watch?v=eCWwKrJyKxA

Moving on, how does a whole genome fits inside a tiny nucleus? To answer this question, we need to look into the concept known as condensation of chromosomes and how DNA is packed into chromatin. There are a lot of different factors associated with the condensation of chromosomes, yet the most important are histone proteins. It would be a good idea to check out the tutoring center’s video on “from DNA to chromosomes”: https://www.youtube.com/watch?v=OOGmKmGmKmA

Also, use the diagram to the right for reference and try to interpret the graph below. Remember to always look first into the variables in both axes before going into the data trends.

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Notice that in the diagram, double strand DNA, which represents an organism’s genome, starts wrapping around histone proteins, which then take a zig-zag structure in order to pack more DNA. Then the zig-zag sequences go into loops, and finally into chromosomes. **This is how DNA is packed inside a nucleus.**

**Let’s check your understanding!**

1. What are histone proteins used for?
2. Experimentally, how are DNA fragments from different sizes measured and separated?

Finally, **how did mitochondria and chloroplasts originate?** First, it is important to notice that a large number of unicellular organisms have almost identical features to these two organelles. **In fact, both mitochondria and chloroplasts have their own copies of DNA, and this is why they are known as SEMIAUTONOMOUS ORGANELLES.** Watch the following 1-minute video to see the details about these 2 organelles: [https://www.youtube.com/watch?v=4pYvM_vjNOM](https://www.youtube.com/watch?v=4pYvM_vjNOM)

Also, the following evolutionary three helps in seeing how unicellular organisms have similar features compared to these two organelles. So what does this mean? The endosymbiotic theory we saw before has the answer for this!

**Let’s check your understanding!!**

3. What makes mitochondria and chloroplasts take the name of semiautonomous?

**Answers!!**

1. Histones are used to wrap DNA around themselves and pack it into chromatin, which is then packed into chromosomes and placed in the nucleus of a cell.
2. DNA fragments (chromatin) are separated by centrifugation and measured using gel electrophoresis.
3. They have their own copies of DNA, capable of replication, and share many features with unicellular organisms.

That’s it this week. Please reach out if you have any questions and don’t forget to visit the Tutoring Center website for further information.

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